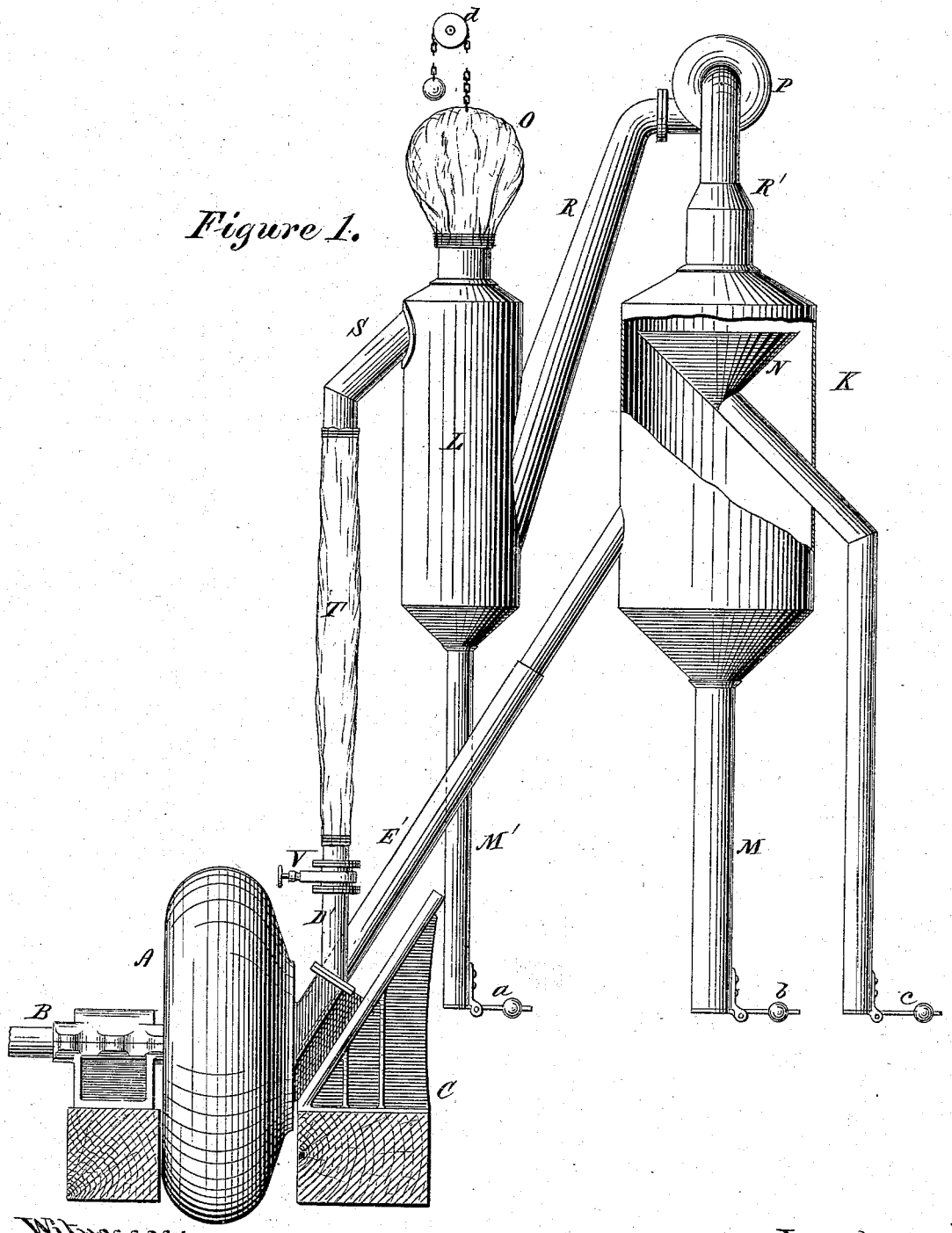
(No Model.) 4 Sheets—Sheet 1.

H. A. DUC, Jr.

ATTRITION MILL.

No. 252,361. Patented Jan. 17, 1882.

Figure 1.



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Charles E. Foster

(No Model.) 4 Sheets—Sheet 2.

H. A. DUC, Jr.

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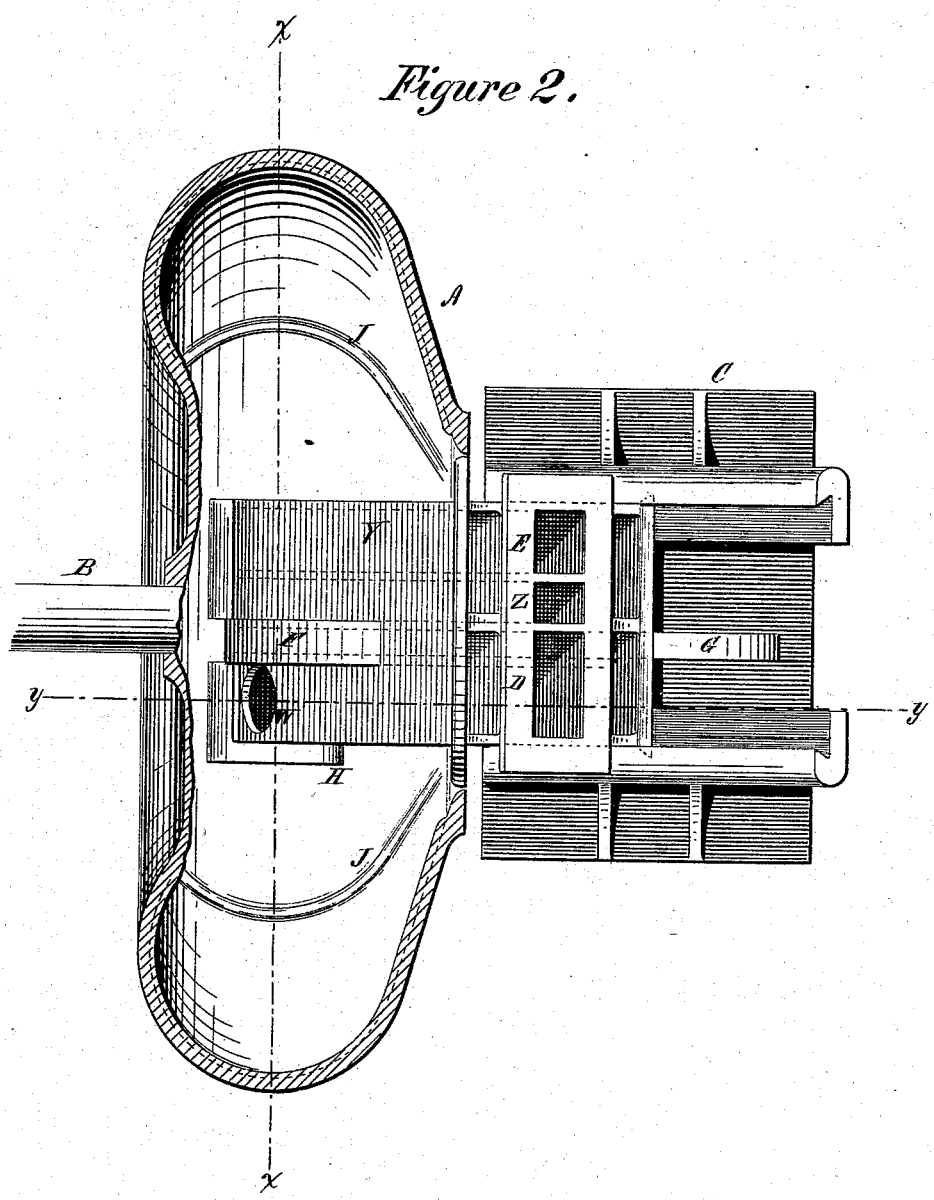
Figure 2.



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(No Model.)

4 Sheets—Sheet 3.

H. A. DUC, Jr.

ATTRITION MILL.

No. 252,361. Patented Jan. 17, 1882.

Figure 3.

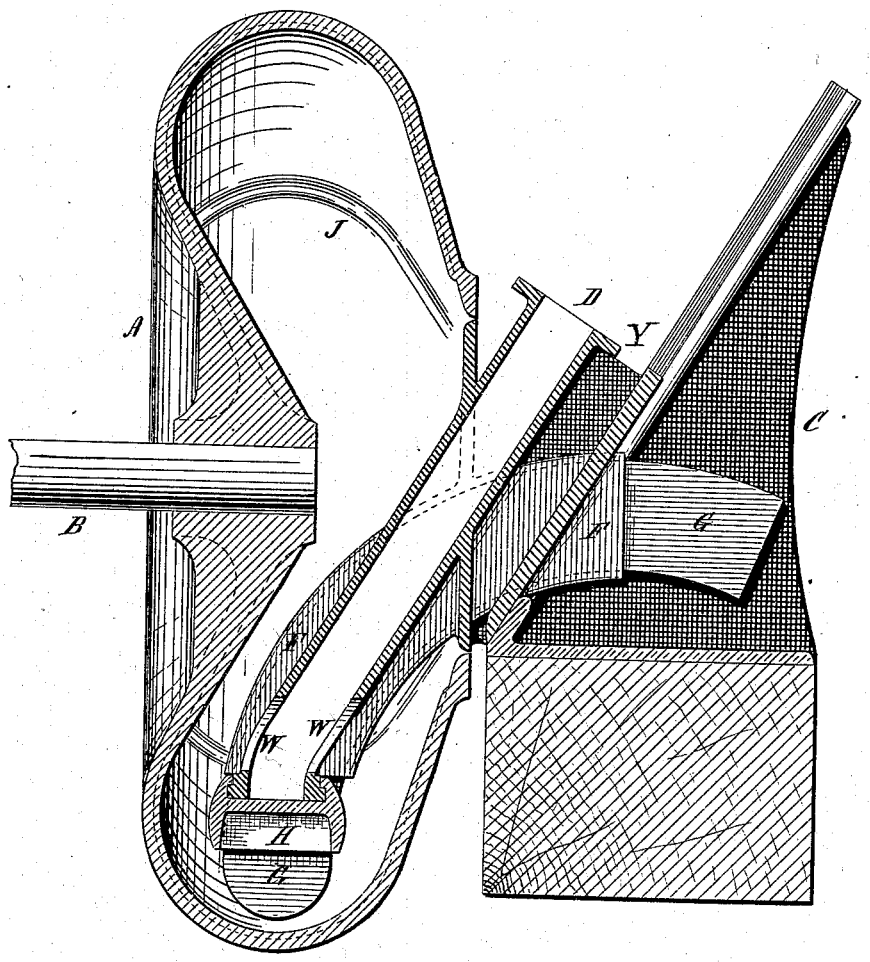
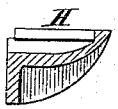


Figure 5.



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(No Model.)

4 Sheets—Sheet 4.

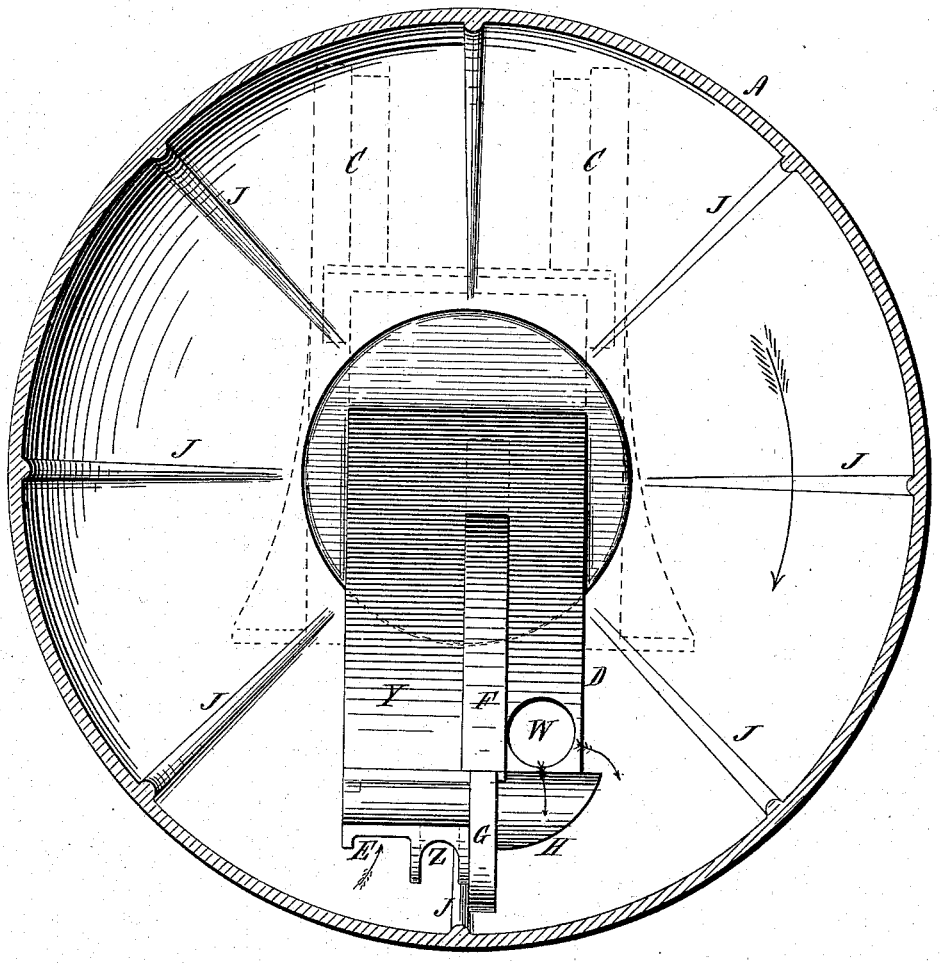
H. A. DUC, Jr.

ATTRITION MILL.

No. 252,361.

Patented Jan. 17, 1882.

Figure 4.



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UNITED STATES PATENT OFFICE.

HENRY A. DUC, JR., OF CHARLESTON, SOUTH CAROLINA, ASSIGNOR OF ONE-HALF TO THOMAS F. ROWLAND, OF BROOKLYN, NEW YORK.

ATTRITION-MILL.

SPECIFICATION forming part of Letters Patent No. 252,361, dated January 17, 1882.

Application filed May 31, 1881. (No model.)

To all whom it may concern:

Be it known that I, HENRY A. DUC, Jr., of the city of Charleston, State of South Carolina, have invented a new and useful Attrition-Mill, of which the following is a full, true, and exact description, reference being had to the accompanying drawings.

In my improved mill the material is reduced by contact and friction against itself, as distinguished from a method of abrading or reducing the material against a grinding-surface not formed of the material itself. My mill is also provided with means for taking up any wear which may occur in it.

That which I consider new in my invention is claimed in the claims hereto annexed.

In my drawings similar letters refer to similar parts.

Figure 1 represents a general view in perspective, part of the apparatus being broken away, of my mill and separating-chambers; Fig. 2, a horizontal section through my mill, showing the feed-passages and plow; Fig. 3, a section through Fig. 2 on the line *y y;* Fig. 4, a section through Fig. 2 on the line *x x;* Fig. 5, a view of the pipe-protecting shoe.

My mill is constructed as follows:

A represents a revolving shell, the shape of which is shown clearly in Fig. 3. This shell is revolved upon a shaft, B, and the shell is preferably so attached to this shaft that when in operation the mass of the material is situated in a plane which intersects the end of the shaft. By this means uniformity of motion and reduction of strain are obtained. The shell A has a circular opening on the side opposite the supporting-shaft, as is clearly shown. Through this opening the feed, air-supply, and air-exhaust passages pass, as also the plow-bar or wearing-surface.

A frame or casting, C, supporting the various contrivances which operate in the mill, is provided, and may be supported in any suitable way. This frame carries a dovetailed slide, Y, (shown clearly in Fig. 2,) which can be slid up on the slideways and removed from the mill. This slide contains passages for the air-supply, the supply of material to be ground, and the air-exhaust, and it also supports the plow, hereinafter to be fully described. The air returning from the separators enters the mill through the passage D, opening into the mill through openings W. The material is fed to the mill through the passage Z, which may be provided with a suitable hopper, and with a valve to close against the external air, if desired. The reduced material is withdrawn through the passage E. The slideway likewise supports, in a suitable channel, F, the self-feeding plow-bar G. The openings W, F, Z, and E are all located together in the bottom of the mill.

Supported upon the slide, and at a point where the material in the mill first meets it, is the removable shoe H. (Shown clearly in Figs. 4 and 5.) This shoe or hood slopes downward toward the end of the plow-bar, and its office is to compact the material to form a grinding-surface against which the rotating material may be abraded. Next in order, the plow-bar G presents itself to the rotating material, and next, again, is the feed opening Z, and next the exhaust-opening E. The openings Z and E are partially protected by projections on the frame-work. The plow-bar G is curved so as to feed downward at right angles to the plane of rotation of the revolving material—that is, its center corresponds with the center of rotation of the revolving material.

The apparatus with which this mill may be connected in practice, in order to secure a continuous operation, is shown clearly in Fig. 1. The exhaust-pipe E connects with the pipe E′, provided with a telescopic joint allowing of the withdrawing of the supporting-frame. This pipe E′ delivers into the selecting-chamber K, which is provided with a delivery-tube, M, and automatic valve *b*.

The funnel N, provided with a delivery-tube, is located in the upper part of this chamber, and delivers at the valve *c*, as shown. This chamber K communicates with blower P by the pipe R′, and the blower P connects at its circumference with pipe R, delivering into the second depositing-chamber, L, which is provided with a delivery-pipe, M′, which pipe is provided with an automatic valve, *a*, as shown. The upper end of this depositing-chamber L is provided with a cloth bag, O, which may be kept extended by cord and weight *d*, as shown.

This balloon or bag O allows for the escape of a certain amount of air in case of a pressure in the chamber L greater than the pressure of the atmosphere, but sifts out any material suspended in the air.

The chamber L is provided with a pipe, S, at its upper portion, which pipe has a flexible tube, preferably made of fibrous material, allowing the passage of the air, which tube is marked T. This tube T communicates with a pipe, D′, provided with valve V, which pipe D′ communicates with the delivery-passage D, by which the air re-enters the chamber.

It will thus be observed that a continuous and substantially closed circuit is provided for the air which is withdrawn from the mill, and which passes through the selecting apparatuses here shown and again back into the mill.

The operation of my apparatus can now be readily understood. The chamber A is caused to revolve at a high velocity in the direction shown by the arrow in Fig. 4 by means of the shaft B and suitable power. The material to be reduced is fed to the mill through the feed-opening Z, which may be provided with a suitable hopper and a regulating apparatus for insuring a continuous feed, if desired. As soon as the material falls into the mill it immediately rotates with the same velocity as the revolving shell, and it is firmly held against the periphery of this revolving shell by centrifugal force, and it is additionally forced to rotate with it by the radial ribs or projections J. In its rotation the material fed to the mill passes underneath the confining and compressing shoe H, and by it is compacted against the plow-bar G into a solid grinding body or surface. The material to be abraded, which is compacted into a rotating annulus or ring within the shell, is continually forced against the stationary material held beneath the shoe H and circumferentially supported by the plow-bar G. So much of said material as passes beneath the plow-bar G is brought under the influence of the exhaust passing upward through the opening E, as shown by the arrows, and this exhaust performs a selecting function upon the material passing beneath it, so as to remove only such material as is sufficiently reduced. The size of the material to be withdrawn can be determined by the velocity of the exhaust.

The depth to which the plow-bar enters the material may be either regulated by hand and a set-screw, or the bar may be allowed to automatically feed to the required depth, its weight carrying it downward, being arrested by the compacted surface of the revolving material against which it would bring up. The feed-openings Z and exhaust-openings E are likewise protected by removable shoes, although but little wear will be experienced in those parts. When the fan P has been put in operation the abraded material, when sufficiently reduced, is drawn through the pipe E′ and escapes into the selecting or depositing chamber K. In this chamber the velocity of the air is greatly reduced, owing to the greater area of cross-section of this chamber than the inlet-passage, and the largest particles which are withdrawn from the mill will fall to the bottom of this chamber and be fed out through the delivery-pipe M and valve *b*. In the upper part of this chamber the funnel-opening N is placed, and there being a greater area for the passage of the air above the funnel N than through the annular opening surrounding it a certain additional amount of reduced material will be there deposited, which material will be of a somewhat finer grade than that passed through the tube M. The blower P withdraws the air and its suspended reduced material through the pipe R′ and forces it downward through the pipe R, where most of the remainder of the suspended material is deposited, owing to another reduction in the velocity of the movement of the air, and escapes through the pipe M′ and valve *a*. Thence the air which has been substantially freed of the reduced material supported in it is passed onward through the pipe S, flexible pipe T, valve V, pipe D′, and return opening D into the mill. By reason of the pervious material of the balloon O, aided, as it may be, by the pervious pipe T, no greater pressure than the pressure of the atmosphere can exist in the pipe R and chamber L, whereby the blower is relieved from any pressure greater than that of the atmosphere acting against it, and a partial vacuum may be maintained in the mill A and exhaust-tubes E E′, so as to prevent the possible escape of any air and dust into the chamber wherein the mill is contained.

By means of the valve V the amount of air to the mill, and consequently the velocity of the exhaust, can be accurately determined.

By means of the sliding frame Y, telescopic joint in pipe E′, and flexible tube T, the feed-openings and plow may be readily withdrawn from the mill. Of course other means might be devised for accomplishing this same result; but I have found those shown to be simple and efficient. When desired, the mill, feed-openings, and bar may be made of other material than iron—as, for instance, some vitreous material—so as to prevent the discoloration due to the slight amount of iron which may be worn off. By making the inner ribs, J, of sufficient width to compress the air in the mill at its periphery the fan P may be dispensed with, when the material is to be reduced to a very fine degree, because then the mill would itself act as a fan forcing the air outward through the air-delivery E′. It is plain, likewise, that different forms of selecting-chambers might be employed without departing from the spirit of my invention. I have shown two selecting-chambers and three delivery-apertures for the material; but it is obvious that one chamber and one aperture might be employed, if preferred.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in an attrition-mill, of a transverse plow or bar extending to the out-

side of the mill, a support for said plow outside of said mill, and appliances whereby the plow may be moved upon said support to the interior of the mill to compensate for wear at the end of the plow-bar, for the purpose specified.

2. The combination of a rotating shell open at one side, and guides, and a curved plow-bar secured in said guides, in which it may be moved in a curved line to carry its end to and from the inner face of the shell, substantially as set forth.

3. The combination, in an attrition-mill, of a rotating shell, a slide, a plow-bar, a feed-tube for delivering the material within the mill, and a frame adapted to permit the slide to be readily withdrawn from the mill and replaced therein, substantially as set forth.

4. An attrition-mill provided with three independent passages delivering into the mill from the outside of the chamber, one for the exhaust of the air from the mill, one for the return of the air so exhausted to the mill, and the other for feeding the material to be reduced to the mill, substantially as set forth.

5. The combination, in an attrition-mill, of a shoe constructed to direct the body of material beneath it, and adapted to compress the said material against the periphery of the mill, and a plow-bar arranged radially across the shell at the rear of and close to the shoe, and adapted to act against said material, substantially as set forth.

HENRY A. DUC, JR.

Witnesses:
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